and leather. Much that has been classed as "techno-geography" and "anthropo-geography" is included in this memoir under "culture-physiology." Frobenius has made a decided gain in lucidity and directness of presentation of his subject by employing this formal nomenclature; in less skillful hands it might lead to the warping of facts to fit them to the plan of research.

A series of 26 charts accompanies the volume upon which the various culture areas are indicated. There is a fascinating appearance of finality about such diagrams, yet, owing to the many sources of error in museum records, from which the charts were made out, they must at best be regarded as provisional and incomplete. The value of the memoir is enhanced by numerous illustrations in the text.

FRANK RUSSELL.

GENERAL BIOLOGY.

Embryos without Maternal Nuclei.[1] — By separating by hand under the microscope the unfertilized egg of the sea-urchin, Delage has obtained one part containing a nucleus and ovicenter and a part devoid of them. When these parts were placed in a drop of water containing a normal egg and spermatozoa were added, spermatozoa entered into all three pieces and all cleaved. The whole egg developed the most rapidly, the nucleated fragment came next, and the enucleate fragment most slowly. All were carried to the gastrula stage; the embryo without maternal nuclei being of small size and having the enteric and blastocœlic cavities nearly obliterated. Thus there has been effected the fecundation and development of a fragment of an egg without egg nucleus and without ovicenter. Delage draws the following weighty conclusions: —

1. It is necessary to reject as too strict the ordinary definition of fecundation — the union of the male and female pronuclei. This union occurs, but is not the essential phenomenon.

2. The definition of Fol — the union of two pronuclei and of two demi-ovicenters with two demi-spermcenters — must also be rejected. It must be rejected also on account of the often observed fact that the absence of the ovicenter offers no obstacle to segmentation.

3. Any theory must be rejected which explains fecundation by the saturation of a female nuclear polarity by a male nuclear polarity,

[1] Delage, Yves. Embryons sans noyau maternel, *Compt. Rend.*, 1898.

and also the theory that accounts for maturation on the ground that it is getting rid of the male element of an originally hermaphrodite egg nucleus.

4. All theories must be rejected which consider fecundation as the furnishing by the male of the number of chromosomes subtracted by the polar globules. The loss of one-half of the chromatic matter does not, of itself, prevent the egg from developing, for the half number of paternal chromosomes can make the egg develop.

5. The sexual attraction is not located in the nucleus.

6. Two things must be distinguished in fecundation: (*a*) the communication to the egg of a vital energy which permits it to segment and to develop; (*b*) the communication to the product of the advantages resulting from amphimixia and the possession of the paternal hereditary characters. As for the second point, my experiment furnishes no indication; as for the first, it shows that the theories of fecundation reconcilable with it are those which present the phenomenon as the conveyance by the male of a special energetic plasm (*Kinoplasma*) contained perhaps in the spermocenter.

7. There is in the ovular cytoplasm no fixed specific architecture whose conservation is a condition of development; if a structure exists, it is conditioned by the mutual reactions of parts and can reëstablish itself as often as it is altered.

8. The celebrated experiment of Boveri, so strongly contested, especially by Seeliger, is demonstrated, if not true, at least possible; the gravest objection that has been made to it (the impossibility of the development of an ovular cytoplasm without nucleus) being experimentally suppressed.

Temperature and Rate of Regeneration.[1] — It has long been known that in every organism there is an optimum temperature for growth above and below which growth occurs more slowly. That the same is true of regeneration has been shown by the recent work of Lillie and Knowlton on *Planaria torva*. Miss Peebles has done similar work on *Hydra grisea* and *H. viridis*. At 18–24° C., of *H. grisea* there regenerated in 2 days 0%; 3 days, 26%; 4 days, 95%; of *H. viridis*, 2 days, 38%; 3 days, 100%. At 26–32° of *H. grisea* there regenerated in 2 days, 75%; 3 days, 100%; of *H. viridis* in 2 days, 98.5%; 3 days, 100%. At 12° C. there regenerated of *Hydra viridis* in 4 days, 13%; 5 days, 24%; 6 days, 71%; 7 days, 100%.

[1] Peebles, Florence. The Effect of Temperature on the Regeneration of Hydra, *Zool. Bull.*, vol. ii, pp. 125–128.